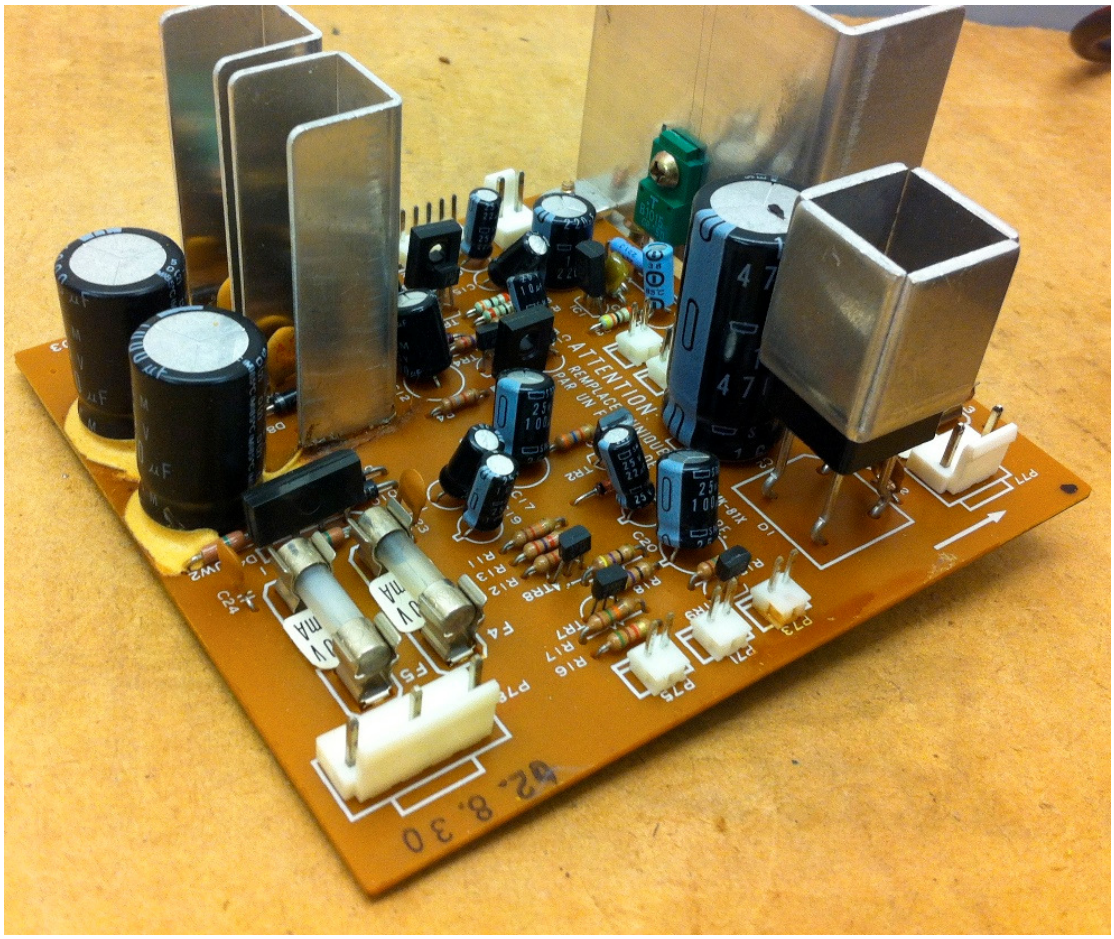
# AKAI S612 PSU Repair & Overhaul Guide

D.A.Wilson, Hideaway Studio, Feb 2017 dan@hideawaystudio.net

| File: AKAI S612 PSU Overhaul Guide Rev 0.1 | Date: 08/02/17 |
|---|---|



**EXTREMELY IMPORTANT**

**The S612 must be unplugged from the mains before and during the repair/overhaul process as there are a number of exposed subassemblies at mains potential posing a very real shock hazard.**

**If there is any doubt at all it is highly recommended the S612 PSU is overhauled by an experienced service engineer.**

## Introduction

The S612 sampler is generally a well designed, solidly built, and reliable design with the notable exception of the PSU board. Now at 30 years old, PSU boards are causing a significant number of S612s to fail.

Although there are a number of failure modes, after fault finding on many of these venerable units, a common root cause has come to light.

**Root Failure Modes:**

The PSU in the S612 is of the linear variety ie. it does not use the higher efficiency type switched mode PSUs found in later designs. Although it could be argued that such supplies are better suited for analog electronics due to their lower noise specifications, they run considerably hotter than their much more efficient modern counterparts.

A number of supply rails are derived from two separate transformer secondaries. The main 5V rail for the digital rails is derived from one secondary and the +/-15V and +/-5V split rails derived from a second centre tapped secondary.

The 5V digital rail has proven to be generally reliable with few failures witnessed although occasionally the main reservoir capacitor may bulge or leak with age and require replacement. The analog rails on the other hand are where the main problems are encountered.

After full wave rectification the unregulated supply rails are passed to two integrated, current limited, 3-pin regulators – a 7815 for the +15V rail and a 7915 for the –15V rail. Cascaded from these are discrete +5V and –5V regulator circuits utilising power series pass transistors.

The root cause of PSU failure in the vast majority of these units is that the series pass transistors in the +/-5V rail regulator circuits go leaky with age. This causes one or more of the supply rails to over-volt and is a failure condition that gradually comes on rather than suddenly failing. As the +/-5V rail voltages slowly exceed their specified voltage the devices that run from these rails consume more current. Eventually the sampler exhibits a permanent failure mode due to this issue but thankfully it is almost always the PSU itself that fails.

Complete failure of the PSU usually, but not always, results in either one or both of the fuses supplying the 15 volt regulators to fail and/or one of the 7815 or 7915 regulators failing along with one or both of the power series pass transistors failing.

**The 100/120V Myth:**

Many S612s found on the second hand market are in fact Japanese imports. In Japan most equipment designed for domestic markets are designed to run on 100V at either 50 or 60Hz. Although some equipment imported from Japan is ok to run at 120V in the US, or via 120V auto-transformers in 220V/240V markets, the S612 is definitely not one of them!!

Although a 100V S612 will appear to run ok at 120V, it will run very hot. The fact of the matter is that at 120V the reservoir capacitors are running at voltages that exceed their rated voltage and the voltage drop across the 5V digital and 15V analog regulators is such that considerably more heat is produced than normal (remember that power in a linear regulator obeys a squared law relationship to the voltage drop across them!).

Although this will not result in instant failure, it will certainly shorten the life of the PSU!

Japanese S612s can be identified by their mains flexes which have very thin grey two core wire with no overall outer insulating core (similar to speaker wire) and a very small 2-pin mains plug with no integral finger guard. Such units should be run on 100V auto-transformers. Domestic US market 120V units have much more substantial mains flexes.

## Returning Failed S612 PSUs to Life…

So your S612 has suddenly refused to correctly power up one day or maybe after a few years in storage… or perhaps someone has sold you one in this state on eBay!!…

Well firstly don't despair… out of the many 612s I have returned to life only 1 unit has suffered a major failure mode other than the PSU board to date.

First and foremost – if you have a S612 that is refusing to power up properly DO NOT LEAVE IT POWERED UP in the hope that somehow it might fix itself!…

### Common PSU Failure Symptoms

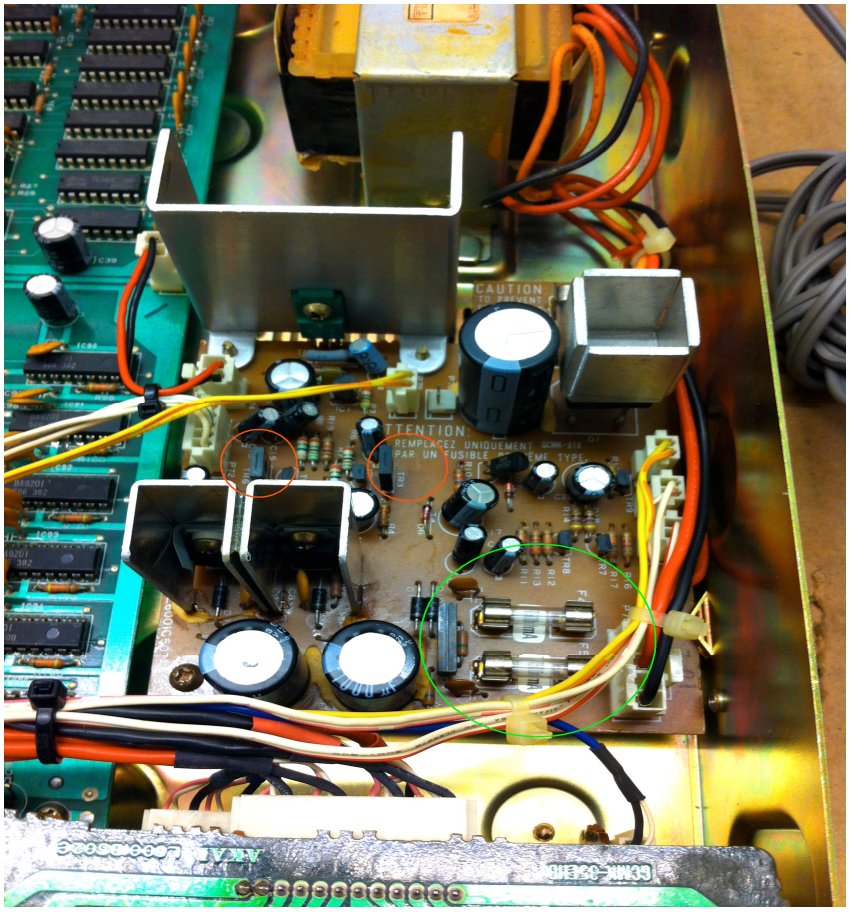
- Unit powers with some front panel LEDs lit & nasty humming sound from the audio output
- Unit powers but no audio is passed
- Unit appears to be totally dead

### The Shot Gun Method…

If you are in a real hurry try the following method to resurrect your S612.

**MAKE SURE THE S612 IS UNPLUGGED FROM THE MAINS POWER FIRST!**

Check fuses F4 and F5 for continuity (circled in green in the image below). If one or more is open circuit it is very important that they are replaced with parts of the correct rating otherwise serious damage may occur on the sampler mainboard in overload conditions.




**DO NOT POWER THE UNIT UP FOLLOWING FUSE REPLACEMENT – THE FUSES WILL HAVE BLOWN DUE FOR GOOD REASON IE. 5V RAIL OVER-VOLTAGE!**

Carefully remove the PSU board assembly by unscrewing both retaining screws and unplugging all the cables making sure not to not to overly stress the connectors and taking note of all the connector positions. NB: some of the connectors have locking barbs.

Desolder power transistors TR3 and TR6 (seen circled in red in image on page 3) taking note of which way round they are facing (ie. with part markings facing towards sampler motherboard).

- **TR3** NPN WAS 2SD1189 - replace with BD131 or MJE340
- **TR6** PNP WAS 2SB8910 - replace with BD132 or MJE350

Both replacement transistors are available from Farnell (element14 in the US):

- MJE340 is FEC order code 1574367
- MJE350 is FEC order code 1574368

Refit board and power for just long enough to determine correct function.

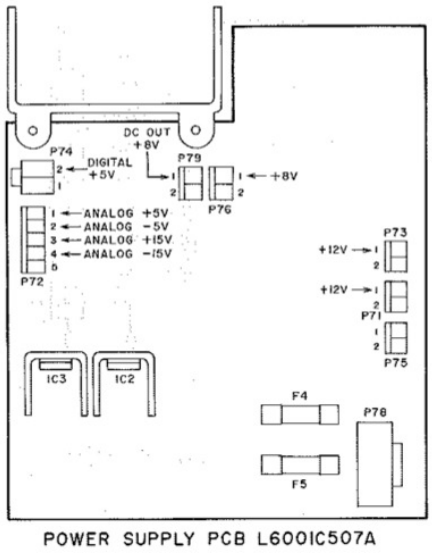
If the S612 powers correctly the supply rail voltages can be verified using a voltage meter between the points shown in the table below: (loaded voltages shown ie. PSU fully installed)

**4-2. B Power Supply Voltage Checks**

After switching power on, check to assure the B voltages to be supplied normally.

| Check Item | Check Point | Result |
|---|---|---|
| ANALOG + 5V | P72-1 | + 5V ± 0.5V |
| ANALOG − 5V | P72-2 | − 5V ± 0.5V |
| ANALOG +15V | P72-3 | +15V ± 1.5V |
| ANALOG −15V | P72-4 | −15V ± 1.5V |
| DIGITAL + 5V | P74-2 | + 5V ± 0.5V |
| DC OUT + 8V | P79-1 | |
| DC + 8V | P76-1 | |
| DC +12V | P73-1 | +12V ± 1.2V |
| DC +12V | P71-1 | +12V ± 1.2V |

Chart-1




POWER SUPPLY PCB L600IC507A

Fog. 4-3 Check point of Power Supply PCB

If problem still persists replace the 7815 (IC2) and 7915 (IC3) regulators making sure that the isolating washer and grey silicone heatsink pad are reinstalled correctly on IC3.

Both replacement regulators are available from Farnell (element14 in the US):

- **IC2** WAS MJM78M15 – replace with LM7815CT (FEC order code 2296025)
- **IC3** WAS MJM79M15 – replace with LM7915CT (FEC order code 2451074)

Please note that the brown substance often found round the base of reservoir capacitors C6 and C7 is a cement that was used to secure them and not the result of electrolyte leakage. A failed or failing capacitor is relatively rare on the PSU assembly but if there is any sign of the top of a capacitor doming then it must be replaced with parts of the same or better specification (eg. Using 105C 63V rated capacitors wouldn't be a bad idea). Pay particular care on ensuring these parts are installed the correct way round observing the polarity markings on the pcb silkscreen!

**Solder Flux Removal & Dry Joints**

As is often the case with mass produced pcb assemblies, the PSU boards were never cleaned of copious amounts of solder flux residue in the factory. Over time this darkens with age forming a brown sticky residue which, in extreme cases, can become slightly conductive.

It is highly advisable to remove this excess flux so that a. the PSU board can be visually inspected for dry joints and b. to reduce the likelihood of the effects of its slight conductivity.

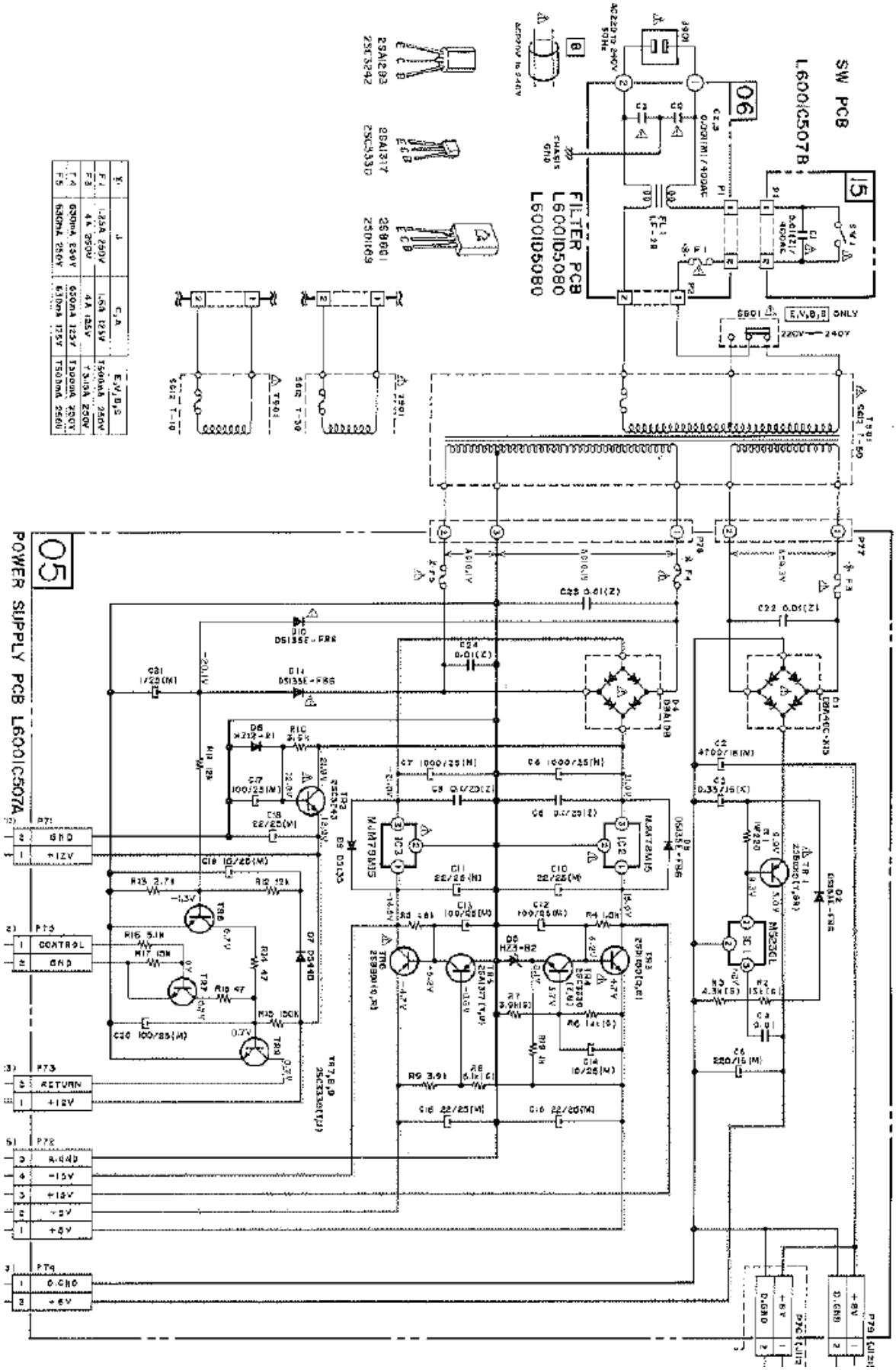
Place the pcb over a container such as an old paint can and spray, pour or brush on a proprietary pcb cleaner or near neat isopropyl alcohol to the solder side of the pcb. A significant amount will be required to completely remove the old solder flux and may need to be applied a few times whilst brushing with an old toothbrush to remove stubborn flux.

Although no harm will come of using excessive cleaner, the board should be allowed to dry before powering it up.

The S612 PSU boards often suffer from dry joints. For some reason some PSU boards are vastly worse than others in this respect. Pay particular attention to dry joints forming around the power transistors and connectors. Any solder joint that looks suspicious should be resoldered.

## Overhaul Process

Having undertaken any essential repairs and verified that the PSU is operational. The overhaul process is basically the full repair process detailed above including:

- Cleaning pcb component side with a brush to remove dust/fluff
- Thoroughly cleaning pcb solder side of old solder flux with isopropyl alcohol
- Carrying out careful visual inspection and resoldering any dry joints
- Replacing all three major reservoir capacitors
- Replacing power transistors TR3 and TR6
- Replacing +/-15V 3-pin regulators IC2 and IC3
- Ensuring fuses are of correct specification
- Reinstalling PSU testing and verifying output voltages are within specification
- Check condition of mains flex in units without IEC sockets
- Soak test unit for several hours

## PSU Schematic